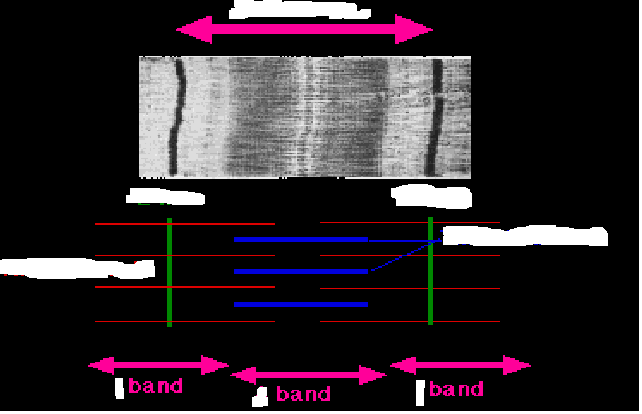
1. List the two basic elements of muscle tissue and their functions
   1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Which of the following are matched appropriately? (pick more than one)
   1. Epimysium, type IV collagen
   2. Epimysium, type I collagen
   3. Perimysium, type I and IV collagen
   4. Perimysium, type I collagen
   5. Endomysium, type I and IV collagen
3. Desmin, vimentin, dystrophin are examples of what?
   1. Microfilaments
   2. Intermediate filaments
   3. Myofibrils
   4. Myofilaments
4. Actin and myosin are types of \_\_\_\_\_\_\_\_\_. Which one is thick? Which one is thin? Are they proteins?

|  |  |  |  |
| --- | --- | --- | --- |
|  | **SKELETAL** | **CARDIAC** | **SMOOTH** |
| **Cell shape** |  |  |  |
| **Sarcomere?** |  |  |  |
| **Nuclei/Cell location** |  |  |  |
| **Cell junctions** |  |  |  |
| **Control of contraction** |  |  |  |
| **Regeneration** |  |  |  |
| **Mitotic division** |  |  |  |

1. S

|  |  |  |  |
| --- | --- | --- | --- |
|  | **RED** | **WHITE** | **INTERMEDIATE** |
| **Fiber type** |  |  |  |
| **Amount of myoglobin** |  |  |  |
| **Amount of glycogen** |  |  |  |
| **Amount of mitochondria** |  |  |  |
| **Contraction** |  |  |  |
| **Length of action** |  |  |  |
| **Oxidative/glycolytic** |  |  |  |
| **Aerobic/anaerobic** |  |  |  |

1. The sarcomere is the region between which two lines?
2. Which of these is responsible for the striated appearance of skeletal muscle?
   1. Myofilaments
   2. Desmin
   3. Myofibrils
   4. Red fibers
3. Label the sarcomere and list what each region and/or band contains



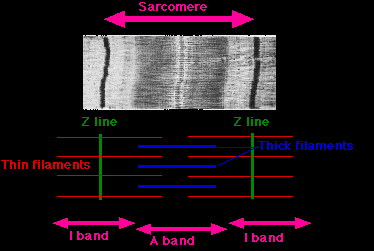
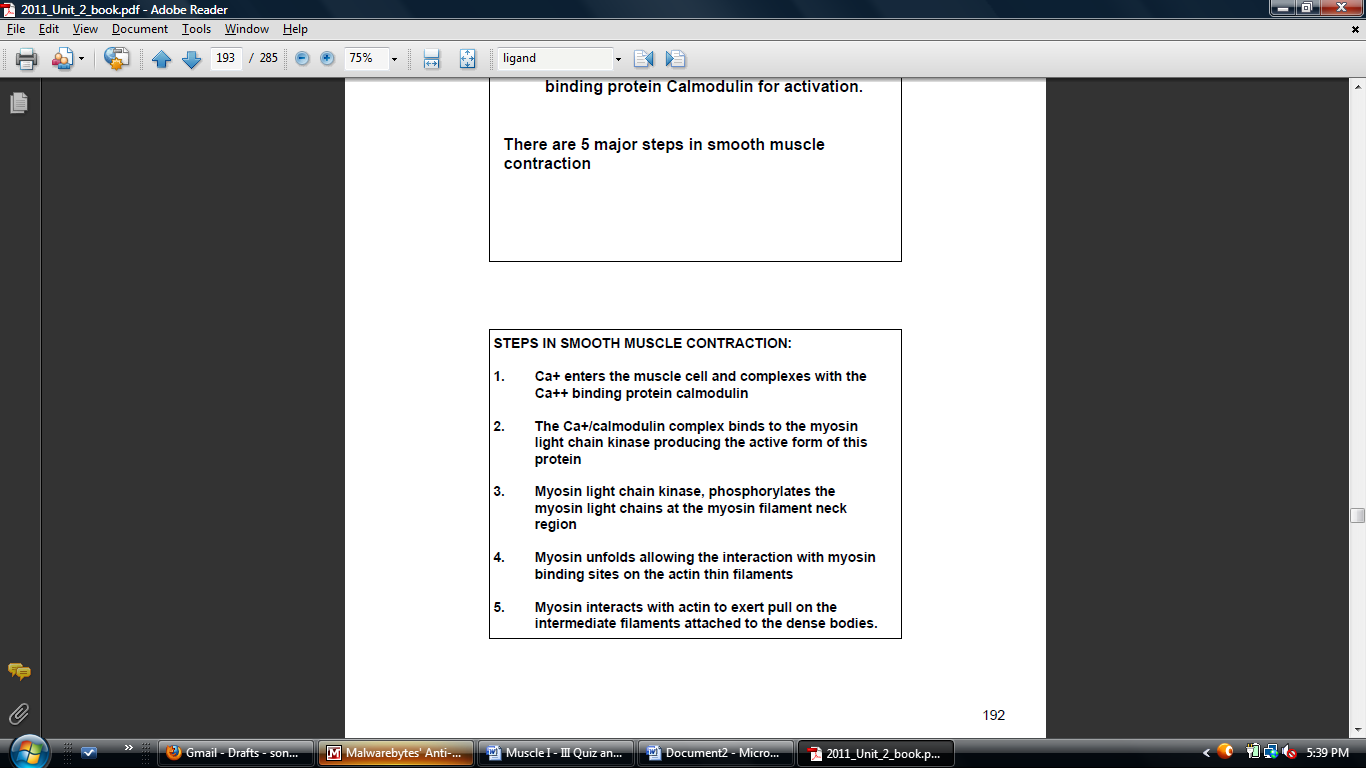
1. Name the 3 proteins of the Z line and their functions
   1. \_\_\_\_\_\_\_\_\_\_\_
   2. \_\_\_\_\_\_\_\_\_\_\_
   3. \_\_\_\_\_\_\_\_\_\_\_
2. About how long is a myosin filament?
   1. 12-15 nm
   2. 1.5 um
   3. 1.5 nm
   4. 3-5 mm
3. In order for calcium stored in the sarcoplasmic reticulum to be released, what must occur prior to this release?
4. During contraction, which of the following are true?
   1. I-band decreases in size
   2. A-band increases and H zone decreases in size
   3. A-band does not change, H-zone decreases in size
   4. I-band does not change
   5. A and C
   6. B and D
5. List the 5 major steps in muscle contraction
6. Define a motor unit.
7. What purpose do junctional folds serve?
   1. To allow more calcium to flow into the cell
   2. Increase surface area available between nerve and muscle contact
   3. No purpose
   4. To allow for involuntary movement
8. What type of channel is responsible for the initial depolarization in the sarcolemma?
9. How much of the ATP involved in the contraction/relaxation cycle is used during relaxation? Give a percentage.
10. Actin binds myosin.
    1. True
    2. False
11. Muscle relaxation involves the transport of Ca \_\_\_\_\_\_\_\_\_\_ of the cell and into the \_\_\_\_\_\_.
12. Calcium removal is an (active/passive) process?
13. Which binding protein binds Ca in the SR lumen?
14. List the three uses of ATP in muscle tissues
    1. .
    2. .
    3. .
15. Loss of dystrophin characterizes which genetic muscular disorder?
16. Which disorder is treated by AChE blockers?
17. Which nerve and which portion of the nervous system works to modulate rate of heart muscle contraction?
18. List 3 ways that cardiac muscle differs from skeletal muscle?
19. Cardiac myocytes are connected by what kind of junctions?
    1. Name the three types of junctional complexes within the major junction and what area they connect (transverse or longitudinal)
20. How many phases does a cardiac muscle AP have?
    1. Plateau phase is characterized by which of the following?
       1. Na efflux
       2. Ca efflux
       3. Ca influx
       4. K influx
    2. Repolarization is characterized by?
       1. Na influx
       2. K efflux
       3. K influx
       4. Ca influx
    3. Depolarization is characterized by?
       1. Na influx
       2. Na efflux
       3. Ca noflux
       4. K influx
21. Removing intracellular Ca in cardiac muscle is done by 3 mechanisms. List them.
    1. .
    2. .
    3. .
22. Cardiac myocytes rotate how many degrees?
    1. 360
    2. 180
    3. 90
    4. 45
23. Which of these are the 4 cytoplasmic organelles that are found near the poles of the nucleus of a SM cell?
    1. Mitochondria, Golgi, smooth ER, ribosomes
    2. rER, mitochondria, Golgi, free ribosomes
    3. smooth ER, nucleus, nuclear membrane, ribosomes
24. In smooth muscle, is the ratio of actin/myosin greater or less than in striated muscle?
25. List the 5 steps in smooth muscle contraction
    1. .
    2. .
    3. .
    4. .
    5. .
26. Calmodulin serves what function in the SM contraction?
27. Multi-unit smooth muscle is found in which of these areas?
    1. Iris
    2. GI tract
    3. Blood vessels
    4. Pupils
28. Acetylcholine and norepinephrine are neurotransmitters for which types of fibers, respectively.
29. Skeletal muscle grows by which of the following?
    1. Hypertrophy
    2. Hyperplasia

ANSWERS

1. A) muscle cells, B) connective tissue
2. B, D, E
3. B
4. Myofilaments; myosin; actin; yes

|  |  |  |  |
| --- | --- | --- | --- |
|  | **SKELETAL** | **CARDIAC** | **SMOOTH** |
| **Cell shape** | Cylindrical | Branched fibers | Fusiform |
| **Sarcomere?** | Yes | Yes | No |
| **Nuclei/Cell location** | Multiple | 1 | 1 |
| **Cell junctions** | None | Intercalated disk, gap junction | Gap junctions |
| **Control of contraction** | Voluntary (all or none) | Involuntary (spontaneous) | Involuntary (slow, forceful) |
| **Regeneration** | Yes (satellite cells) | No | Yes |
| **Mitotic division** | No | No | Yes |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **RED** | **WHITE** | **INTERMEDIATE** |
| **Fiber type** | Type I | Type II B | Type II A |
| **Amount of myoglobin** | Increased | Decreased | Intermediate |
| **Amount of glycogen** | Decreased | Increased | Increased |
| **Amount of mitochondria** | Increased | Decreased | Increased |
| **Contraction** | Slow | Very fast | Moderately fast |
| **Length of action** | Long acting | Rapidly fatigued | Intermediate |
| **Oxidative/glycolytic** | Oxidative | Glycolytic | Both |
| **Aerobic/anaerobic** | Aerobic ATP production | Anerobic ATP production | Aerobic and anaerobic production |

1. Z lines
2. C
3. 
4. A) Z-line protein - anchoring protein; B) Alpha actinin - binding protein for actin; C) Cap Z - caps the + ends of the thin filaments
5. B
6. Depolarization of the muscle cell membrane
7. E
8. 1) Generation of action potential along afferent nerve fiber, 2) Synaptic transmission of afferent impulse and muscle cell depolarization, 3) Release of Ca++ from SR, 4) Unmasking of myosin binding sites on actin, 5) Binding of myosin to actin and power stroke
9. Motor axon and all of the muscle cells that it contacts.
10. B
11. Ligand gated Na+ channels
12. 50%
13. False. Myosin binds actin.
14. Out; SR
15. Active
16. Calsequestrin
17. A) powers the power stroke; B) required to break rigor complex; C) powers Ca++ ATPase ion at SR during relaxation
18. Muscular dystrophy
19. Myasthenia gravis
20. Vagus (IX), autonomic nervous system
21. Cardiac myocytes are short, myocytes directly connected by cell-cell junctions, rely 90% on oxidative phosphorylation for energy
22. Intercalated disks 🡪 1) Fascia Adherens (transverse), 2) Desmosomes (transverse), 3) gap junctions (longitudinal)
23. A) iii, B)ii, C)i
24. A) Ca++ -ATPase on the SR membrane, B)Na+-Ca++antiport system in the sarcolemma, C) Ca++-ATPase on the sarcolemma
25. B
26. B
27. Greater
28. 
29. Binds Ca++ and activates myosin light chain kinase
30. A
31. Parasympathetic fibers; sympathetic fibers
32. A